ZOOM
TECHNOLOGIES

VMware

Course Presentation

VMware Vsphere

Certification Mapped Course

Course Presentation

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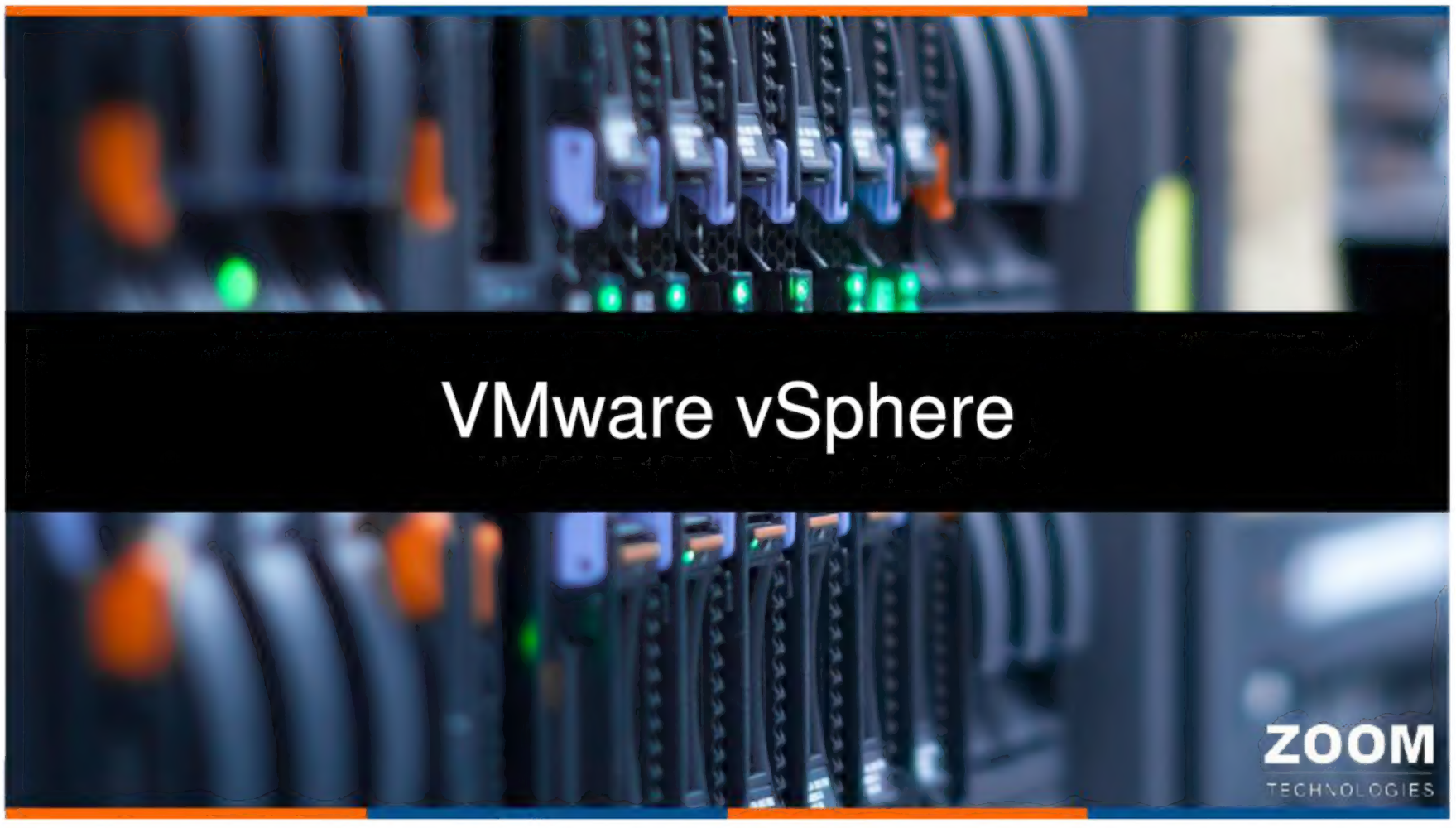

vSphere Product Suite Components:

- **ESX/ESXi**
- **vSphere Client**
- **Web Client**
- **vCenter Server**
- **Update Manager**
- **vSphere Data Protection**
- **vShield End Point**
- **vCenter Standalone Converter**
- **vCLI, vMA**

History of ESX/ESXi

- First Release 2001, ESX1.0
- ESXi Release 2006-2007, ESXi3.0
- vSphere 4.0 Release 2009, ESX/ESXi4.0
- vSphere 4.1 Release 2010, ESX/ESXi4.1
- vSphere 5.0 Release 2011, Only ESXi5.0
- vSphere 5.1 Release 2012, ESXi5.1
- vSphere 5.5 Release 2013, ESXi5.5
- vSphere 6.0 Release 2015, ESXi6.0

Difference Between ESX & ESXi

ESX 4.0	ESXi 4.0
VMkernel + Kernel RHEL	Vmkernel
Installation Media 760MB	360MB (Approx)
Installation & Booting slow	Installs & Boots Faster
More Patching Requirement	Less patches
Less Secure	More Secure

- ESXi4.0 VMkernel Console Hidden, Basic configuration by DCUI, Managed only through remote management tools.
- ESXi4.1 VMkernel Console Open, Known as Tech support Mode, Should be enabled in DCUI
- ESXi5.0 VMkernel Console, Known as shell access, Should be enabled in DCUI, Firewall introduced.

Virtual Machine

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- Functionally Equal to a Physical Machine
- Virtual Hardware
- Supported OS can be installed
- Set of Files, stored in a folder

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Terminology

- ESXi Host (Physical Machine Running ESXi)
- ESXi - Hypervisor (Virtualization layer)
- VM (Virtual Hardware)
- Guest OS (OS Installed on a VM)
- Applications (Run on Guest OS)

ESX/ESXi - File system

- VMFS - Virtual Machine File System

Features

- Clustered File System
- Distributed Locking

Virtual Networking

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- Virtual Network Adaptors
- Virtual Switches
- VMs Get Connected to Virtual Switches
- Virtual Switches Get connected to Physical Network Adaptors
- Physical Network Adaptors get connected to Physical Switches

Virtual Datacenter Infrastructure

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Servers

Types of Servers

- Tower Servers
- Rack mount Servers
- Blade Servers

Network

- Ethernet
- Fiber Optic
- Switches, Routers, Firewalls

Centralized Storage

- SAN (Storage Area Network)
  FC SAN, iSCSI SAN
- NAS (Network Attached Storage)

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Server Virtualization Software (Hypervisor) VMware vSphere

- Virtual Machines
- Virtual Networking
- Virtual Storage

Guest Operating Systems

Applications

Internet

- Leased Lines
- Broad band
- VPN (Virtual Private Network)

Cloud Computing Software

- VMware vCloud Director

Resource Sharing

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- VMs Running on ESXi host are allocated a portion of Physical Resources
- Hypervisor Schedules VMs, allocates memory and schedules VMs to run on various CPUs
- VMs share Network and Disk Bandwidth
- VMs can be allocated with specific resources
- Default setting, All VMs on an ESXi host receive an Equal share of resources

CPU Virtualization

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- Emphasizes Performance
- Hypervisor runs instructions when needed to make VMs operate as if they were running directly on a Physical Machine
- Multiple VMs running on ESXi host may compete for CPU resources, ESXi host time-slices the Physical processors across all VMs, each VM runs as if it has a specific number of vCPUs.

Virtualized Host Memory Usage

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- When a VM gets started Hypervisor creates a contiguous addressable memory space for VM
- Memory space allocated is configured when the VM is created and has same properties as that of virtual address space.
- This allows the hypervisor to protect the memory of each VM from being accessed by others

VMFS

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- Clustered File System
- Distributed Locking
- VMFS uses distributed Journaling of its file system meta data changes to allow fast recovery in the event of hardware failure
- VMFS is the foundation for vMotion, SVMotion, automated restart of VMs and FT
- VMFS provides an interface to storage resources to access the datastores on which VMs reside
- VMFS datastore can be dynamically expanded with no down time
- VMFS stores all the files that makeup a VM in single directory

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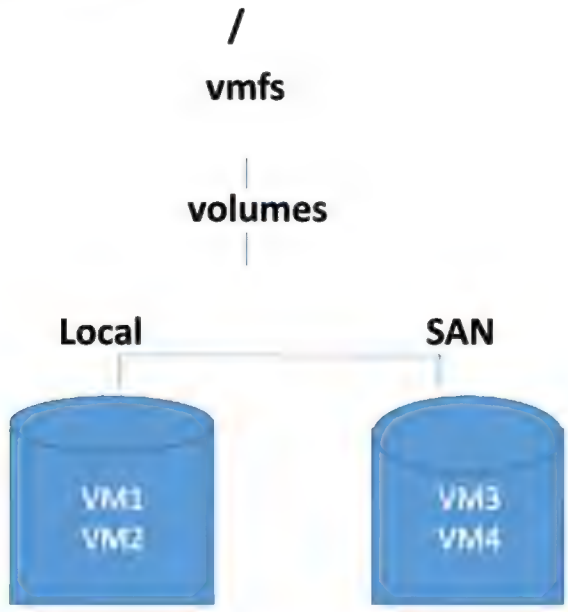
- VMFS datastore uses a file structure similar to Linux/Unix
- Each datastore is mounted to folder



Installing ESXi

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ESXi versions

- Free version VMware vSphere Hypervisor

Licensed Versions

- VMware vSphere Standard
- VMware vSphere Enterprise
- VMware vSphere Enterprise Plus

How ESXi is Secure

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- Memory Hardening
- Kernel Module Security
- Trusted Platform Module

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Where can I Install ESXi

- Hard Disks
- SAN LUNs
- USB Devices
- SD Cards
- Directly in to the Memory (Embedded)

ESXi Hardware Requirements

- 64 Bit Processor x86 (Min 2 Cores)
- (Intel Xeon/Nehalem, AMD Opteron + Virtualization Technology VT-X/AMD-V)
- RAM 4GB (Min)
- Ethernet Card
- (Min 1 Gigabit/10 Gigabit) Preferred More
- Storage Adaptors
- SCSI adaptor, FC adaptor, CNA, iSCSI adaptor, Internal RAID Controller
- Disks
- SATA, SCSI,SAS,FC LUN, iSCSI, RAID LUN

ESXi Max Hardware Support

- Up to 320 Logical CPUs (Cores or Hyperthreads)
- 512 VMs/Host
- 4TB RAM

Check HCG! For the Server Models, CPUs, Mother Boards, Controllers, Storage etc.

Installation of ESXi

- Have the ESXi ISO CD/DVD or USB Flash Drive
- Boot the system
- Make sure to select a disk which is not formatted with VMFS
- vSphere 5.1 onwards uses GPT format this supports installation on disks>2TB up to 64TB
- ESXi creates a 4GB Scratch partition and remaining space is formatted with VMFS-5
- Scratch partition is used for storing temporary data including logs, diagnostic information, and system swap.

vSphere Client

- It is a GUI used to connect to an ESXi host or vCenter Server to manage your vSphere infrastructure
- Can be Installed from the vCenter Server installation media
- Can be downloaded from the internet
- vSphere Client is only for Windows

Virtual Machines

- VM is a set of discrete files
- Set of Virtual hardware
- Supported OS can be installed

VM Files

- .vmx (configuration File)
- .vmdk (Disk descriptor file)
- -flat.vmdk (Disk data file)
- .nvram (VM's BIOS file)
- .log (VM's current log file)
- .vswp (Swap files)
- .vmsd (Snapshot descriptive file)
- .vmsn (Snapshot state file)
- -delta.vmdk (Snapshot disk file)
- .vmtx (Template file)
- -rdm.vmdk (Raw device map file)
- VM has additional lock file if it resides on NAS
- VM has change tracking file if it is backed up with VDP

VM Hardware

- Up to 64 vCPUs
- Up to 1TB RAM
- Up to 10 NICs
- Up to 4 SCSI adaptors 15 devices/adaptor
- 1 IDE controller 4 devices
- 1 USB controller 20 devices
- Up to 3 parallel ports
- Up to 4 serial/com ports
- 1 Floppy controller 2 devices
- HD audio
- Hardware 3D
- Key board
- Mouse
- Upto six PCI vSphere DirectPath devices to a VM

VM – Max CPU & RAM

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- **Up to 64 vCPUs**

  This depends on the number of CPUs available on the host and the number of CPUs the guest operating system supports

  VMware vSphere Virtual Symmetric Multiprocessing: Configuring a VM with multiple vCPUs

- **Up to 1 TB RAM**

  This depends on the amount of RAM configured on the VM (Max amount of physical memory a VM can use)

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Virtual Disk

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ESXi offers diff types of virtual SCSI adaptors:

- **Bus Logic Parallel, LSI Logic Parallel, LSI Logic SAS and VMware Paravirtual**

Types of Virtual Disks:

- **Thick Provision Lazy Zeroed**
- **Thick Provision Eager Zeroed**
- **Thin Provision**

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Virtual NIC

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Fliexible

- vlance: Emulated version of AMD79C970 Pcnet LANCE NIC supported by most 32 bit guest OS Except vista and later
- vmxnet: Optimized for performance Functional only after the Installtion of Vmware Tools

E1000

- Emulated version of Intel 8254EM Gigabit, drivers available in XP and later guest OS and Linux 2.4.19 and Later, Default for 64 Bit guest OS.
- Required for VLAN guest tagging support

E1000e

- Emulated version of Intel 82574L Gigabit
- e1000 or e1000e depends on Guest OS

Vmxnet2

- Based on vmxnet, provides high performance features like jumbo frames and hardware off-loads

Vmxnet3

- Not related to vmxnet/vmxnet2, available only on VM hardware version 7 onwards, supported only on limited set of guest OS, features like IPV6 support, multiqueue support and MSI/MSI-X interrupt delivery, supports FT.

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VMware Tools

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- Suite of Utilities
- Features
  - Replaces generic drivers with VMware drivers
  - Device Drivers: SVGA display, vmxnet, Balloon Driver for Memory mgmt, Sync driver for quiescing I/O, Improved mouse
  - VM Heartbeat
  - VMware Tools Service for Time Synchronization
  - Ability to shut down VM
  - Adds additional perfmon monitoring options
  - 5.1 reduce reboots when upgrading to newer versions of VMware Tools

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Virtual Appliances (VA)

- A preconfigured VM with guest OS and the required software or application installed designed for a specific task like a firewall, backup and recovery utility etc.,
- Deployed as an OVF template
- OVF is a platform independent, open packaging and distribution format for VMs
- Downloaded from VMware VA Marketplace
- Deployed using vSphere Client on vCenter Server or ESXi host inventory

vCenter Server

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- It's a service
- Central Administration point for ESXi hosts and VMs in your Infrastructure
- Can Manage Max 1000 hosts/vCenter
- Can Manage 10000 VMs Powered on, 15000 VMs Registered/vCenter
- Provides Advanced Features: VMware vSphere vMotion, SvMotion, DRS, HA and FT
- Multiple vCenter Server can be joined to a vCenter Server Linked Mode Group

vCenter Architecture

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- VMware vSphere Client/Web Client
- vCenter Server Database (Critical)
- vCenter SSO
- Active Directory Domain
- Hosts & VMs

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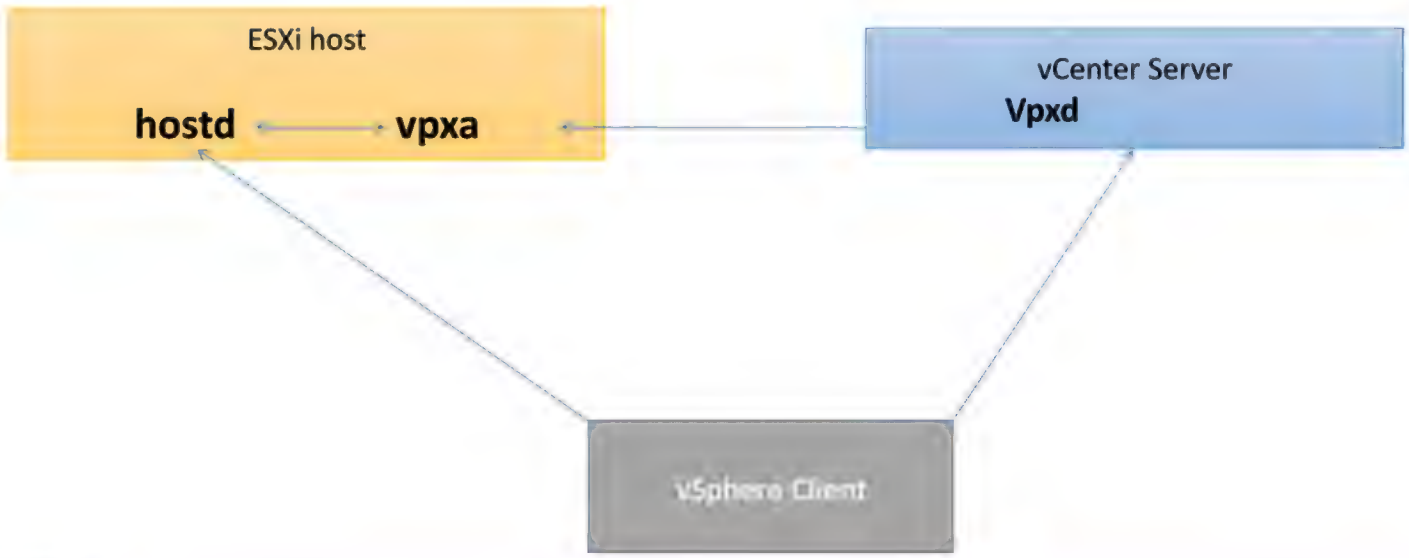
Communication Between vSphere Client ESXi Host & vCenter Server



vCenter Server Services

- Core services
  - Host & VM config, VM provisioning, Mgmt of resources & VMs, Tasks, scheduling, statistics logging, Mgmt of alarms & events
- Distributed services
  - vMotion, SvMotion, DRS, HA
- Additional Services
  - Vmware vSphere Update Manager
- Database interface
- AD interface
- Vmware vSphere API & vSphere SDK

vCenter Server Modules

Update Manager

Site Recovery Manager

- These are Applications which provide additional features in vCenter Server
- These modules have server client component
- Server Component is installed on vCenter server and Client component (Plug-in) downloaded and installed to vSphere Client

vCenter Server Plug-ins

- VMware vCenter Storage Monitoring Service
- vCenter Hardware Status
- vCenter Service Status

vCenter Single Sign On

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Benefits	Features
Speeds up Operations	Auto discovery of and less complexity vCenter servers
Trust between Components	Support for multiple or non AD repositories Users can view all vCenter instances in single view
Support for Open Standard Protocols SAML2.0/WS-trust	Linked mode not required
Better Architecture	

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How SSO Server Functions

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- Customer Identity Sources: AD, Open LDAP, NIS, Local OS Users, SSO Users
  - Users log in to Web Client
  - Credentials are sent to SSO Server
  - STS receives and forwards it to IDM
  - IDM Forwards request to the Identity source
  - User Authenticated IDM updates STS, STS generates Security Token
  - Users can access vSphere Solutions

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SSO Components

- STS service issues (SAML) tokens
- SSO Admin Service Configures SSO server and manage users & groups
- Lookup service contains topology information about vSphere infrastrusture
- Identity Manager Service, Identity Manager Client
- VMware Directory Service (vmdir)

vCenter Server Supports

- OpenLDAP versions 2.4 and later
- AD versions 2003 and later
- AD over LDAP
- Local OS System Users
- SSO Users & Groups

Installation of vCenter Server

- Components
  - SSO Server
  - Web Client
  - Inventory Service
  - vCenter Server
  - Min Hardware Requirements for SSO on a Separate Machine
- Intel/AMD dual core x64 processor
- 3GB RAM
- 2GB disk storage
- 1Gbps NIC

vSphere Web client

Install to vCenter Server or remote machine

Web client Architecture

- Web client
- Application Server
- vCenter Server

Web client Plug-ins

- Run from server

vCenter Inventory service

- Stores vCenter Server application & Inventory data
- Search and access inventory of Multiple vCenter servers linked
- Supports login by SSO
- Used by vSphere Web Client

Hardware Requiremets

- Intel/AMD x64 2or more cores 2GHz
- 3GB RAM
- 2GB disk storage
- 1Gbps Network

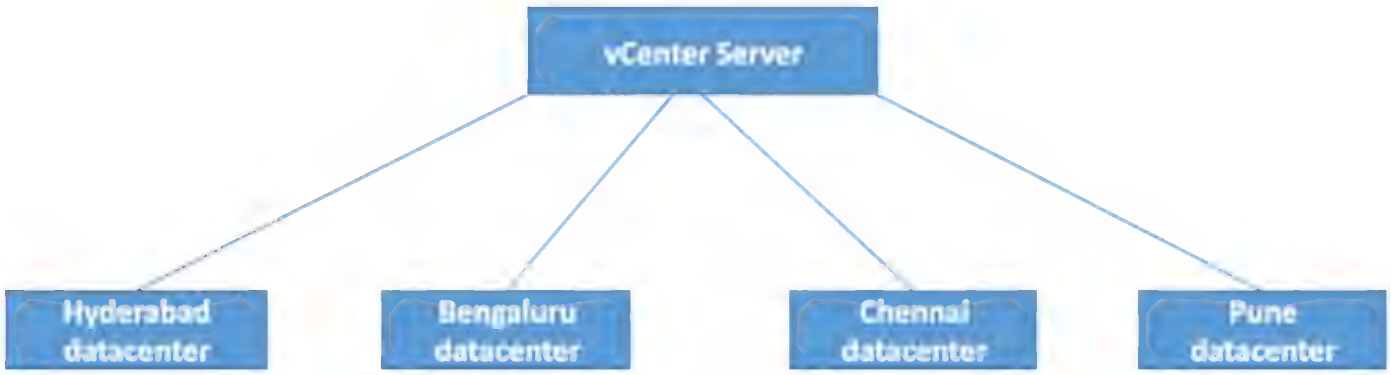
vCenter Server

- Hardware Requirements
  - Intel/AMD x64, 2 or more Cores, 2GHz
  - 4GB RAM
  - 4GB disk storage
  - 1Gbps Networking
- Requires a database
- Software Requirements
  - 64 bit OS
  - 64 bit database

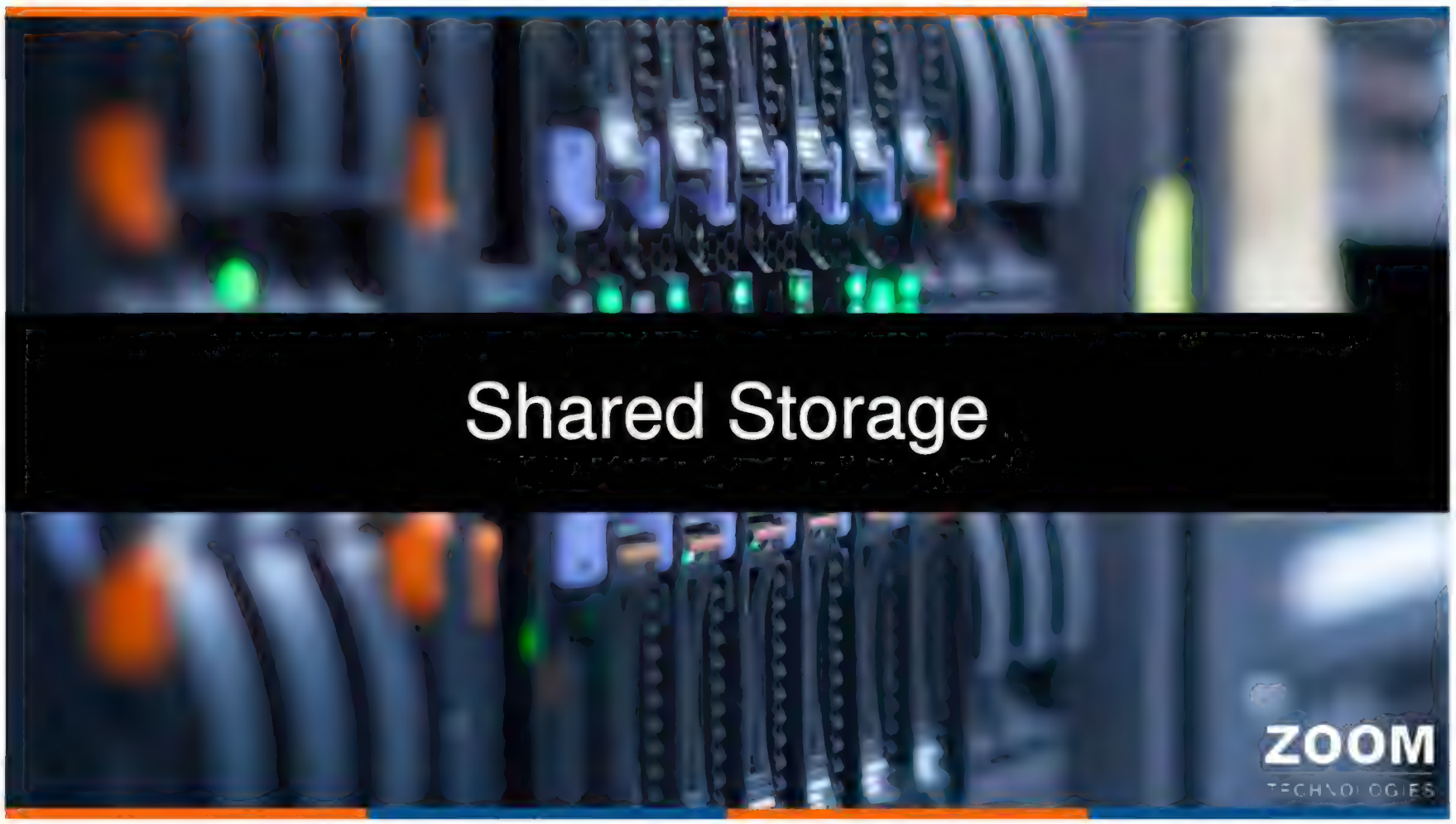
vCenter Server Database Requirements

- Supported Databases
  - MS SQL Server 2005 SP3 (SP4 recommended)
  - MS SQL Server 2008
  - MS SQL Server 2008 R2 Express
  - Oracle 10g R2 & 11g
  - IBM DB2 9.5 and 9.7

vCenter Server Inventory



- Hierarchy of Objects
- Objects can be Folders or Objects that we manage
- Objects can be grouped in a meaningful way so that permissions can be applied



Datastore: Logical Container that holds files

Types of datastore

- **VMFS: datastores formatted with VMFS**
- **NFS: formatted with a file system (NFS) of storage provider**

Types Storage Technologies:

- **DAS: Direct attached storage**
- **FC: protocol used for SANs, Encapsulates SCSI commands transmitted between FC nodes, FC Switch Connects nodes.**
- **FCoE: FC traffic encapsulated in to FCoE frames, FCoE frames are converged with networking traffic**

- iSCSI: SCSI transport protocol, provides access to storage devices over TCP/IP network
- NAS: Provides access to storage shared using a file system(NFS) over TCP/IP network, NFS protocol.

VMFS can be deployed on SCSI based Storage

- DAS, FC, iSCSI

ESXi supports NFS version3 over TCP/IP, uses a lock file .lck-fieldid

iSCSI SAN Storage

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- Components
- iSCSI Storage system
- Hard disks (arrays)
- LUNs
- SPs
- TCP/IP network
- Servers (hosts)

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- iSCSI Initiator transmits SCSI commands over TCP/IP network
- iSCSI target receives SCSI commands from TCP/IP network
- Target presents LUNs to initiator

iSCSI addressing: IQN can be 255 characters

iqn.yy-mm.com.company:iSCSI alias

eg: iqn.1999-08.com.someit:storage1-67df4c98 (target), IP address: 10.0.1.9

eg: iqn.1998-01.com.vmware:test1-95cd4c35

(initiator), IP address: 10.0.1.20

or

EUI -16 characters

eg: eui.bdfcab9876543210 (target)

eg: eui.0123456789abcdef (initiator)

24 bits for company name assigned by IEEE and 40 bits for uid

iSCSI initiators

- Sofware iSCSI initiator
- Dependent Hardware iSCSI initiator (broadcom 5709)
- Independent Hardware iSCSI initiator (QLE4062c)

iSCSI Security Uses CHAP

ESXi supports iSCSI Multipathing (Port Binding)

NAS/NFS

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NFS Components

- NAS device/NFS server
- TCP/IP Network
- ESXi host
- ESXi host accesses NFS server using IP address/HN
- NFS administrator should use no_root_squash option to export an nfs volume
- ESXi supports NFS multipathing

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FC SAN

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FC Components

- FC Storage System
- Disk drive arrays
- LUNs
- SPs
- FC Switches
- ESXi hosts with
- HBAs

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- LUN: address of a Logical unit, LU is a unit of storage, LU can be a JBOD/RAID set can be partitioned in to multiple LUNs
- SP: partitions JBOD/RAID sets in to LUNs can restrict access to a particular LUN from Servers
- HBA: Connects ESXi host to FC network
- FC Switch: Forms FC fabric, interconnects multiple FC nodes, add source and destination address to packets

- FC Addressing
- WWN unique 64 bit address assigned to FC nodes eg: 60:08:05:E0:10:20:B2:78
- Access Control in FC
- LUN Masking: Configured at SP
- Zoning/Zones: Configured at FC switch
- Soft Zoning/Hard Zoning
- ESXi supports 16Gbps FC, supports multipathing
- VMkernel scans for LUNs 0-255

FCoE

- Components
  - FC SAN -LAN
- FCoE Switch
- ESXi Host
- with CNA/NIC with
- sw FCoE supprt

Storage device naming

- SCSI storage devices use various identifiers on ESXi hosts
- VMkernel requires an identifier generated by storage device

Identifiers:

- SCSI ID: unique address of a SCSI device
- Canonical name: The NAA ID is a unique LUN identifier, persistent, begins with naa
- T10 : assigned by IEFT begins with t10
- mpx: Vmware namespace, non persistent, local devices use mpx
- Runtime name: uses convention vmhba:N:C:T:L created by host, not persistent

Snapshot

- **Captures Present State info of the VM**

Clones & Templates

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- Template is a master image copy of a VM
- Contains Guests OS, Application and VM configuration
- Clone is an exact copy of a VM
- Use Guest Customization Wizard to customize the guest OS during cloning and deployment from template

vApp

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- Container for one or more VMs
- vApp is an object
- CPU & Memory can be allocated & configure startup and shutdown order for VMs
- vApp also be deployed using OVF/OVA
- OVF has an XML file and VMDKs of VMs
- OVA is from xensource is an archive file which has files that belong to OVF directory

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Types of Migration

- Cold
- Suspended
- vMotion
- Storage vMotion
- Enhanced vMotion

- Max of 8 simultaneous vMotion, cloning, deployment, SvMotion, accesses/VMFS-5 datastore

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- 128 Concurrent vMotion/VMFS datastore
- 4 Concurrent vMotion/host on 1Gbps network
- 8 Concurrent vMotion/host on 10Gbps network
- CPU compatibility between hosts required for vMotion
- SSE3, SSSE3 or SSE4.1 CPU instructions on hosts
- NX/XD CPU technology

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vMotion Technology

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- vMotion migrates the VM's entire state from one host to another
- VMkernel port for vMotion enabled on source and destination host

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Storage vMotion

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- Uses the same technology as vMotion
- Storage vMotion migrates the VM files from one datastore to another
- Datastores can be of different storage types
- VMkernel data mover/VAAI
- Start new VM process
- Mirror Driver
- Storage vMotion performs upto 4 parallel disk migrations/storage vMotion operation
- Parallel disk migrations apply only betw diff datastores
- 2 Concurrent SvMotion/Host, 8/Datastore
- VMDKs must be in persistent mode
- Migrate Virtual RDMs mapping file or convert thick/thin if the destination is not NFS datastore
- Physical RDMs, migrate only the mapping file

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Enhanced vMotion

- Migrate VM host & datastore simultaneously with out a shared storage
- Hosts must be in same datacenter and same network
- Only 2 Concurrent Enhanced vMotion/Host

vSphere HA

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Configured, managed and monitored in vCenter Server

Provides high availability against:

- ESXi host failure
- VM/Guest OS failure
- Application Failure (Optional)

Cluster is a group of ESXi hosts and its VMs with VMware vSphere HA and DRS enabled

32 hosts/cluster, 512 VMs/host, 3000 VMs/cluster

vSphere HA Architecture

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- All the hosts in a HA cluster have Master/Slave relationship
- HA is enabled, Fault Domain Manager service starts on each ESXi host, FDM agents start.
- FD is managed by Master host
- Cluster configuration info is maintained by vpxd process and is updated to the master agent
- List of protected VMs is stored on each datastore
- HA depends on Network Heartbeats, Datastore Heartbeats

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HA failure Scenarios

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- Salve Host failure
- Master Host failure
- Isolated Host

Avoid Isolated host scenario by having redundant heartbeat network/isolation addresses

- Network Partition

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Configuring vSphere HA

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- Enable host monitoring (vSphere HA monitors and responds to host failures
- Admission control refers to the amount of available resources that can be used to start VMs on an ESXi host
- VM monitoring

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vSphere DRS

- DRS is a cluster managed by vCenter Server
- ESXi host resources becomes part of cluster resources
- DRS has these resource management capabilities
  - Initial placement
  - Load balancing
  - Power Management

DRS Settings

DRS Affinity Rules for VMs

- Affinity rules: DRS should try to keep certain VMs together on the same host
- Anti-affinity rules: DRS should try to make sure certain VMs are not together

DRS Groups

- VM DRS Group
- Host DRS Group
- VM/Host can belong to multiple DRS groups

VMs to Host Affinity Rule specify whether a VM DRS Group can run on specific Host DRS Group

Rules

- Preferential rule is softly enforced can be violated

eg: VMs of Group A/B are forced to Run on Host of Group A/B respectively

- Required rule is strictly enforced can never be violated

vSphere FT

- Provides zero downtime and zero data loss for applications in the event of unplanned downtime
- vSphere HA required
- Can be used with DRS cluster
- 4 VMs/Host
- Disable BIOS-based power management (Host)

Update Manager

- Provides centralized patch, version management of ESXi hosts, VM hardware, VMware tools and VAs

- Update Manager 5.1 can be used to patch
- ESXi 3.5, 4.x and 5.x
- Upgrade ESX/ESXi 4.x to ESXi 5.x

Components of Update Manager

- Update Manager Server
- Patch Database
- Update Manager Plug-in

Hardware requirements

- CPU 2 or more Cores, 2GHz
- 2/4GB RAM
- 1Gbps Network

Access & Authentication

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- Configuring Security Profile Services
- ESXi Firewall
- Lockdown Mode
- Integrating ESXi with AD

Access Control

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- Privilege: Defines action that can be performed
- Role: Set of Privileges
- Object: Target of the action
- User/Group: Who can perform the action
- Role+User/Group+Object=Permission

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Applying Permissions Scenarios

- Scenario 1: Permissions can propagate down the object hierarchy to all subobjects, you can also explicitly override a permission at lower level objects
- Scenario 2: When a user is a member of multiple groups with permissions on the same object. The user gets both the permissions
- Scenario 3: When a user is a member of multiple groups with permissions on diff objects, both roles propagate to their child objects
- Scenario4: Permissions defined explicitly for the user on an object take precedence over all group permissions on that same object

vSphere Data Protection

- Traditional Backup Solutions not suitable for Virtual Architecture
- Virtual Backup Solutions Advantages:
  - No backup agents on VMs
  - Backup processing is offloaded from ESXi hosts to backup server
  - Virtual disks can be thin provisioned, use of snapshot functionality
  - Faster backup and recovery
  - Single backup image
  - Image level and file level restoration

- vSphere Storage API Data Protection(VADP) built in to the ESXi framework
  - API directly integrated with third party backup tools
  - Supports all types of storages FC,iSCSI,NAS,Local
- vSphere Data Protection can restore individual files
- Incremental backups using VDP

VDP Components & Architecture

- VDP Appliance
  - .ova format, VM with 4vCPUs, 4GB RAM, SLES 11 64bit
  - VA- .5TB-850GB,1TB-1.6TB,2TB-3.1TB
- vSphere Infrastucture
  - CBT, VSS in VMware tools
- Integrated with vCenter Server 5.1
- Managed Through Web Client
- De-duplication Store (.vmdk files)

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Memory Virtualization has 3 layers

- Guest OS virtual memory
- Guest OS physical memory
- Host physical memory

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VM Memory Overcommitment

- Occurs when physical memory installed is less than sum of memory allocated to all VMs
- VMs power on only if minimum memory available, that is overhead memory
- VMs overhead memory is extra host physical memory
- Swap file (.vswp) size is the diff betw allocated and reserved memory

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VMkernel memory reclaim techniques

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- Transparent page sharing
- Ballooning mechanism
- Memory Compression
- Host-level SSD swapping
- Page VM memory out to disk (VMkernel Swap)

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CPU virtualization

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- VMkernel Schedules vCPUs on the physical processor
- Socket, Core, Thread Topology
- CPU load balancing

LINUX

Resource Control

ZOOM TECHNOLOGIES

- ❖ vSphere 5.x employs a share based allocation algorithm to allocate resources for VMs
- ❖ Parameters that control a VMs access to a given resource are
  - Limit (Cannot exceed this value)
  - Reservation (VM to start)
  - Shares (Guarantee a certain amount of resources for a VM)

Resource Pools

ZOOM TECHNOLOGIES

- ❖ Logical abstraction for hierarchically managing CPU and memory resources
- ❖ Allows administrators to divide and allocate resources to VMs

Resource Pool Attributes

- Shares: Low, Normal, High, Custom
- Reservations in MHz and MB
- Limits in MHz and MB
- Expandable reservation? yes, no

LINUX

Resource Pool Scenarios

- Host esxi1
- CPU:10000MHz
- Memory:32GB

Finance Pool
CPU shares 1000
Reservation 1000MHz
Limit 4000MHz
Expandable reservation yes

Fin-Prod VM
CPU shares 1000
Reservation 0MHz
Limit 4000MHz

Fin-Dev VM
CPU shares 2000
Reservation 250 MHz
Limit 4000MHz

All VMs are running on same CPU

Finance pool
CPU shares 2000

Marketing Pool
CPU shares 1000

Fin-test VM
CPU shares 1000

Fin-prod VM
CPU shares
2000

Mar-test VM
CPU shares 1000

Mar-prod VM
CPU shares 2000

Monitoring

ZOOM TECHNOLOGIES

Monitoring VM resource usage

- CPU
- Memory
- Disk
- Network Bandwidth

Monitoring Tools

GUEST OS TOOLS	VMWARE TOOLS
Perfmon dll	vCenter perf charts
Task Manager	ESXi System Logs
Iometer	resxtop and esxtop

Interpreting Data from monitoring tools

ZOOM TECHNOLOGIES

- Is a VM CPU Constrained?
- Are VMs CPU Constrained?
- Is the VM Memory Constrained?
- Is the Host Memory Constrained?
- Monitoring Active Memory of VM
- Are VMs Disk-Constrained?
- Are VMs Network-Constrained?

LINUX

Network Policies

- **Security**
- **Traffic Shaping**
- **NIC Teaming**

Security Policy

- **Promiscuous Mode: (default reject) to prevent VMs network adaptors from observing traffic not intended for**
- **MAC Address Changes: (default accept) if set to reject, when guest OS tries to change the MAC, it stops receiving frames**
- **Forged Transmits: (default accept) if set to reject the virtual NIC drops frames that the guest sends if the MAC is changed**

Traffic Shaping Policy

- **Mechanism for controlling VMs network bandwidth**
- **Controls outbound traffic only**

Average Bandwidth: Allowed average load

Peak Bandwidth: Max amount of bandwidth vSwitch can pass without dropping packets

Burst Size: Max amount of data included in a burst

ZOOM TECHNOLOGIES

NIC Teaming Policy

- **Load balancing Method (outbound only)**

Originating Virtual Port ID: NIC is determined by the port ID to which VM is connected. Fast & Simple

Source MAC Hash: NIC is based on virtual NICs MAC address. Low overhead, might not spread traffic evenly across the physical NICs

IP Hash: NIC is chosen based on packets source and destination IP address. High Overhead, better distribution of traffic, requires 8802.3ad standard

LINUX

ZOOM TECHNOLOGIES

Network failure Detection

- **Detected by VMkernel**
- **Link Status Only: Provided by network adaptor detects failures like cable pulls & physical switch power failures**
- **Beacon Probing: link status plus detect configuration errors like port blocked by STP and wrong VLAN**

LINUX

Notify Switches

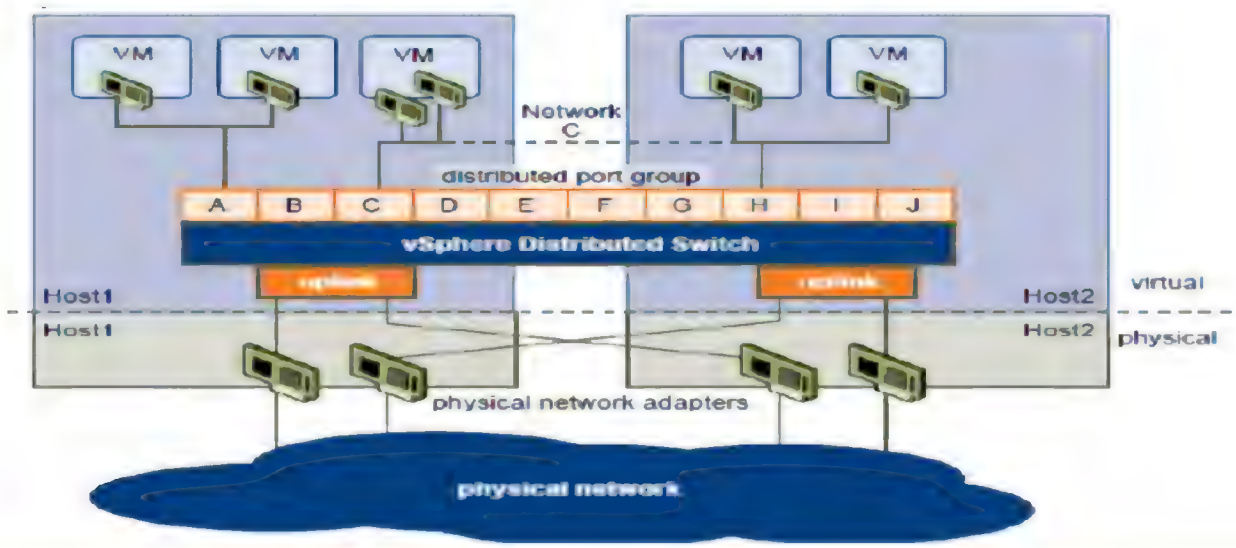
- **Physical switches are notified by VMkernel when a virtual NIC is connected to virtual switch and when a failover event causes a virtual NICs traffic to be rerouted to a diff physical NIC**

- **Do not use this option with VMs running unicast mode MS NLB**

Failback

- **Yes: Failed physical adaptor is active whenever its up**
- **No: Failed adaptor is inactive even after its up**

- **Configured and Managed at vCenter Level**
- **vSphere Distributed Switch functions as a single virtual switch across all the associated ESXi hosts**



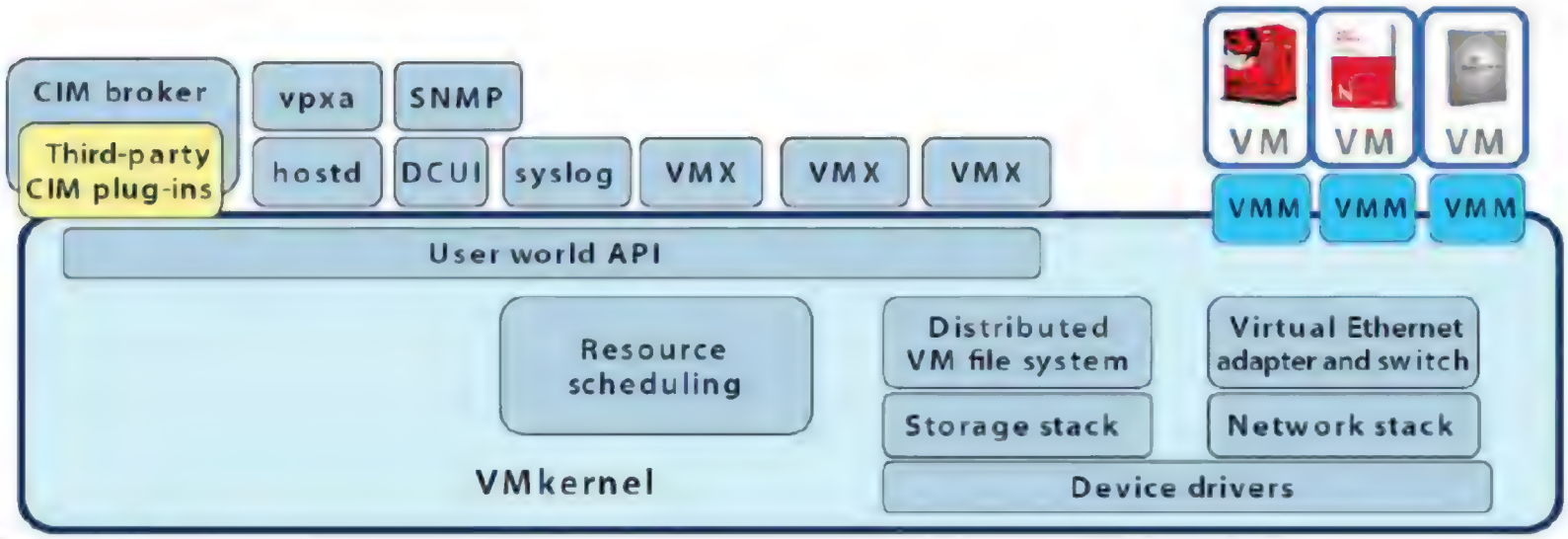
- With VLAN Type set to None, the dvPort group will receive only untagged traffic. In this case, the uplinks must connect to physical switch ports configured as access ports, or they will receive only untagged/native VLAN traffic.
- With VLAN Type set to VLAN, you'll then need to specify a VLAN ID. The dvPort group will receive traffic tagged with that VLAN ID. The uplinks must connect to physical switch ports configured as VLAN trunks.
- With VLAN Type set to VLAN Trunking, you'll then need to specify the range of allowed VLANs. The dvPort group will pass the VLAN tags up to the guest Oses on any connected VMs.
- With VLAN Type set to Private VLAN, you'll then need to specify a Private VLAN entry.

- PVLANs are a way to further isolate ports within a VLAN
- PVLANs are configured in pairs: the primary VLAN and any secondary VLANs. The primary VLAN is considered the downstream VLAN; that is, traffic to the host travels along the primary VLAN. The secondary VLAN is considered the upstream VLAN; that is, traffic from the host travels along the secondary VLAN

ESXi Architecture

ZOOM TECHNOLOGIES

- Functionally, ESXi is equivalent to ESX 3
- Footprint less than 32MB of memory.



LINUX

ZOOM TECHNOLOGIES

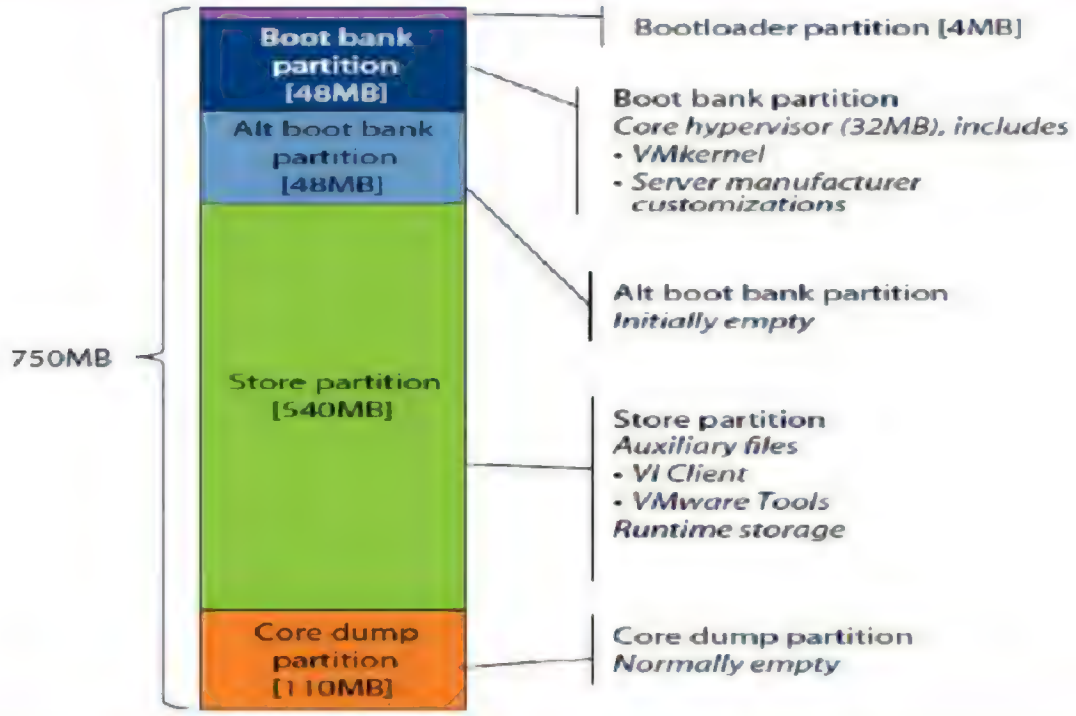
- VMkernel is a POSIX-like operating system
- Core functionality as:
  - Resource scheduling
  - I/O stacks
  - Device drivers
- VMkernel uses a simple in-memory file system to hold the ESXi configuration files /etc/vmware , log files /var/log/vmware , and staged patches in /tmp

LINUX

Components/Processes

- DCUI
- VMM the process that provides the execution environment for a virtual machine, as well as a helper process known as VMX. Each running virtual machine has its own VMM and VMX process.
- The hostd process provides a programmatic interface to VMkernel and is used by direct VI Client connections as well as the VI API. It is the process that authenticates users and keeps track of which users and groups have which privileges. It also allows you to create and manage local users.
- vpxa process
- HA agent
- Syslog daemon stores logs and forward logs to remote servers

- A process that handles initial iSCSI target discovery
- Process that enable NTP
- Process that enable SNMP
- The Common Information Model (CIM) system: CIM is the interface that enables hardware-level management from remote applications via a set of standard APIs.
- User and group definitions are stored on the file system in the files /etc/passwd, /etc/shadow, and /etc/group



Command Line Tools

- SSH Client (Putty)
- vCLI
- vMA

Using vCLI commands

Use esxcli commands or vicfg commands

Eg:

vicfg-vswitch --server <vCenter host name> --vihost

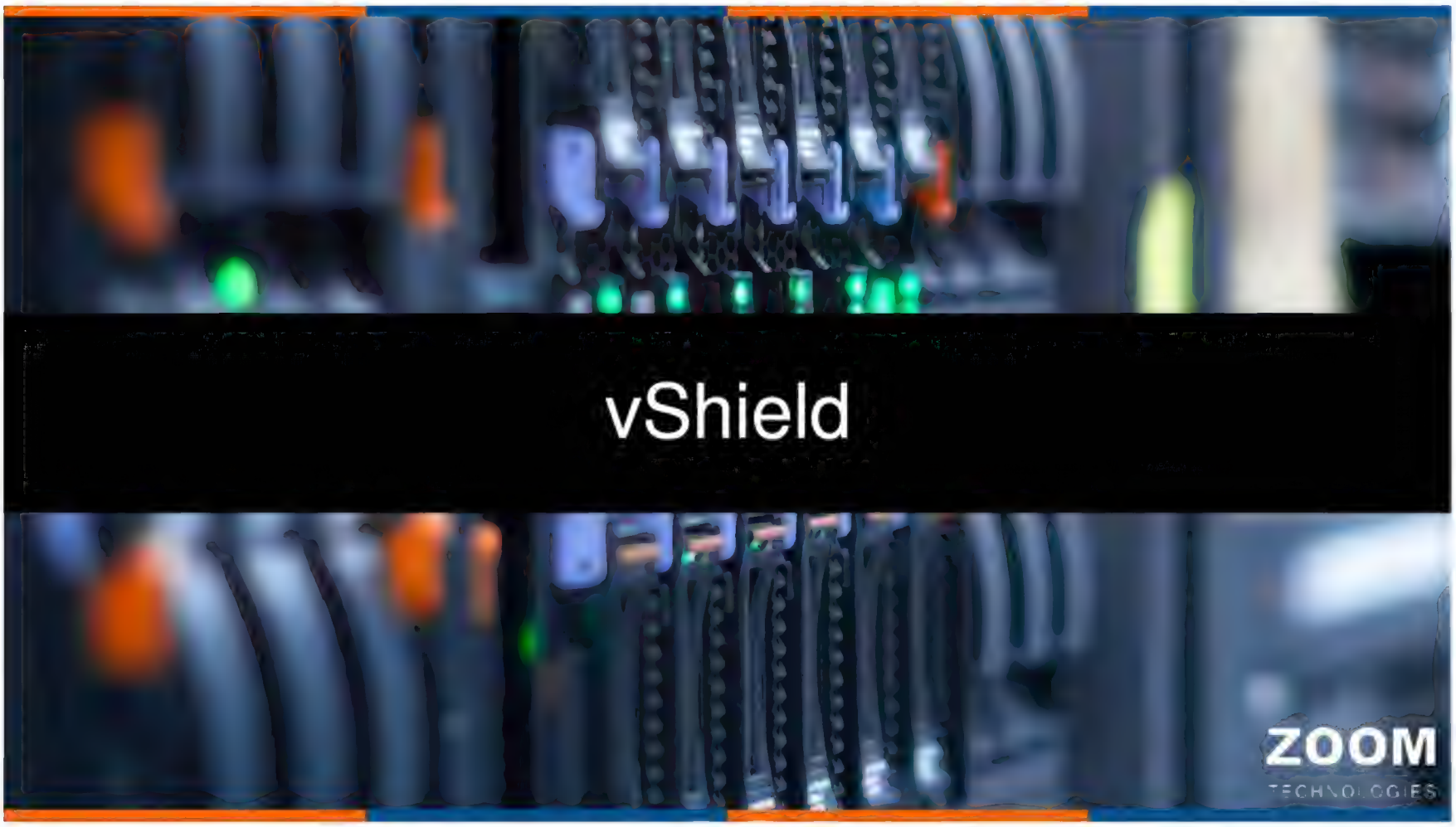
<ESXi host name> --username

<vCenter administrative user> --list

vicfg-hostops --server <vCenter host name> --vihost

<ESXi host name> --username

<vCenter administrative user> --operation shutdown --force



vShield

- vShield Manager
- vShield Edge: Protects the edge of virtual datacenter
- vShield App with Data security: Hypervisor-based, application aware firewall for virtual datacenter
- vShield Endpoint: Offloads antivirus and antimalware agent processing to a dedicated secure VA delivered by VMware partners
- Endpoint is integrated with vSphere 5.1

VSAN

ZOOM TECHNOLOGIES

- VMware Virtual SAN uses local SSDs as cache and Local HDDs to create a clustered datastore.
- VSAN requires min 3 ESXi Host to form a VSAN Cluster and Max of 8.
- Atleast 1 SSD and 1HDD on each host is required with local storage
- VSAN Cluster requires a dedicated network

Configuring VSAN

ZOOM TECHNOLOGIES

- VMkernel network for VSAN
- Create a VSAN Cluster
- Configured through Web Client
- Single VSAN datastore is created

LINUX

vSphere Replication

- vSphere Replication protects VMs from Disaster by replicating the VM to a remote site
- vSphere Replication is handled by components of hypervisor
- vSphere Replication is a VA vSphere Replication Appliance
- Managed Through Web Client

Host Profiles

- Host Profile creates a profile of the host configuration
- Provides centralized managed automated mechanism for host configuration

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